WHITE ROCK BRIDGE
Bridge Road, spanning Pawcatuck River and
White Rock Canal
Westerly
Washington County
Rhode Island

HAER No. RI-39

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Northeast Region
Philadelphia Support Office
U.S. Custom House
200 Chestnut Street
Philadelphia, P.A. 19106

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RI
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HISTORIC AMERICAN ENGINEERING RECORD

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Location: Bridge Road, spanning Pawcatuck River and White Rock Canal
Westerly
Washington County, Rhode Island

USGS Ashaway Quadrangle
UTM Coordinates: 19.262370.4586540

Date of Construction: 1906

Engineer/ Contractor: National Construction Company

Present Owner: Town of Westerly
Department of Public Works
45 Broad Street
Westerly, Rhode Island 02891

Present Use: Not in use

Significance: White Rock Bridge is significant as an example of early 20th-century truss engineering and as an increasingly rare artifact associated with electric street railways. Built for the Norwich and Westerly Railway Company, which operated a 22-mile interurban line between Norwich, Conn., and Westerly, R.I., the bridge was unusual in that it provided separate structures for highway and trolley traffic, with a common center truss. The electric railway ceased operation in 1922; the highway part was in use until 1976.

Project Information: This documentation was undertaken in accordance with a Memorandum of Agreement between the Federal Highway Administration and the State Historic Preservation Offices of Rhode Island and Connecticut. The bridge is scheduled to be partially demolished and rebuilt in 1994.

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Description

White Rock Bridge is a riveted steel truss bridge crossing the Pawcatuck River and the White Rock Canal in Westerly, Rhode Island. Because the river forms the boundary between Rhode Island and Connecticut, the west end is in the town of Stonington, Connecticut. The bridge also crosses the White Rock Canal, a rubble-walled tailrace for a 19th-century textile mill located upstream from the bridge on the Rhode Island side. The span crossing the river is 126' long, while the canal span is 75' long. In addition to these two major spans, there is a 33'-long I-beam approach at the west end. The bridge runs at a level about 10' to 15' above the surface of the river, depending on conditions. The general vicinity of the bridge includes a town highway garage and storage area on the east side and a small factory on the west side, though the bridge's immediate surroundings are wooded and heavily overgrown with trees, vines, and brush.

The bridge is known as Bridge No. 65 in the records of the Rhode Island Department of Transportation and as No. 4182 in the records of the Connecticut Department of Transportation. The road carried by the bridge is called Bridge Road on the east or Westerly side and White Rock Road on the Stonington side. The bridge is commonly known as White Rock Bridge.

Although it is typical of early 20th-century truss engineering in its design and in the detailing of its components, White Rock Bridge is unusual in that it is a combined highway and electric railway structure, with separate rights-of-way for each. Although it was common in the period to carry streetcar traffic on highway bridges by providing greater load capacity, particularly in the floor system, usually the tracks simply ran along the roadway, not in a dedicated right-of-way. Because it provided separate side-by-side structures for each mode of transportation, at the same time using a common center truss, White Rock Bridge necessitated an unusually complex configuration.

Each of the bridge's two major spans is made up of three trusses; of the six, only two are identical. In this report, the north set of trusses is referred to as the highway trusses, the south set as the railway trusses, and the shared middle set as the center trusses. The trusses are set 16' apart on center.

The railway river truss and center river truss are the largest components of the structure and together form a through truss about 20' in depth for the railway river crossing. The

railway river truss is a five-panel Pratt truss. The center truss is similar, but its panels are subdivided by additional half-diagonals and verticals, giving it the configuration of a Baltimore truss. Both sides have subdiagonals in the end panels. This portion of the bridge has the following as its main components:

Inclined end posts and top chord: box girder formed of channels and plate with the underside latticed, 12" x 18".

Lower chord: I-section formed of angles with a web of stay plates 46" on center, measuring 10" x 11" overall.

Diagonals: channel girders formed of angles and latticing, 5" x 10", in the center panel; lattice girders, 10" x 10 1/2", in the second and fourth panels. Subdiagonals, including those in the end panels, are channel girders formed of angles and latticing, 4" x 10".

Verticals: lattice girders, 10" x 10 1/2".

Top bracing: lattice-girder struts, the deepest of which are those across the portals; the other struts have T-section sway bracing. Only a vestige remains of the tension-rod cross-bracing.

By creating ten panels in the center truss, the extra verticals and subdiagonals allowed the center truss to connect with the floor systems of both the five-panel railway truss and the ten-panel highway truss.

The highway river truss is much lower (10' in depth) and has no overhead connection to the common center truss, making this portion of the bridge a pony truss. The highway river truss is a ten-panel Warren truss with a full set of verticals. It consists of the following components:

Inclined end posts and top chord: box girder formed of channels and plate with the underside latticed, 10" x 16"; the top chord in the middle four panels is deeper, measuring 12 1/2" x 16".

Lower chord: I-section formed of angles with a web of stay plates 42" on center, measuring 7" x 9" overall.

Diagonals: channel girders formed of angles and latticing, 4" x 9" in the center four panels and 6" x 9" at the ends.

Verticals: lattice girders, 6" x 9".

The railway canal truss and center canal truss are identical five-panel Pratt pony trusses. They measure 10' in depth and have the following as their components:

Inclined end posts and top chord: box girder formed of channels and plate with the underside latticed, 12" x 18".
Lower chord: I-section formed of angles with a web of stay plates 44" on center, measuring 10 1/2" x 10 1/2" overall.

Diagonals: channel girders formed of angles and latticing, 3" x 10 1/2" in the center panel and 6" x 10 1/2" at the ends.

Verticals: lattice girders, 8 1/2" x 10 1/2".

The highway canal truss is also a five-panel Pratt truss, but its members are lighter and it is a few inches less in depth than the railway side:

Inclined end posts and top chord: box girder formed of channels and plate with the underside latticed, 7" x 16".

Lower chord: I-section formed of angles with a web of stay plates 32" on center, measuring 7" x 9" overall.

Diagonals: channel girders formed of angles and latticing, 2 1/2" x 9" in the center panel and 3 1/2" x 9" at the ends.

Verticals: lattice girders, 6 1/2" x 9".

The bridge's abutments are constructed of reinforced concrete and provide a shelf for the end bearings of the canal span and the I-beams of the west approach span. The bridge's intermediate piers consist of concrete-filled riveted iron-plate cylinders, 5' in diameter, with a set of three piers located at the west end of the river span and another three on the embankment that separates the canal from the river. The

canal span bearings are fixed shoes and the river span bearings are pinned shoes.

The substructure of the railway side consists of a pair of longitudinal 7" x 24" I-beams (6" x 20" in the canal span) bearing on 12 1/2" x 30" plate-girder cross-beams; the 78" spacing of the longitudinal I-beams suggests that cross-ties were used to support the rails. The floor structure has cross-bracing of 3" x 5" (river span) and 3" x 3" (canal span) angles. A large water main currently carried on this part of the bridge is supported by sections of street-railway girder rail, which may be presumed to have been salvaged from the bridge after the railway was discontinued in 1922. Girder rail, which has a guide shoulder for the wheel flanges on the inside of the rail, was primarily used in urban areas in order to minimize disruption of the paving; in this bridge, the function of girder rail would have been to reduce the chance that cars would derail while on the bridge.

The highway spans' substructure consists of 6 1/2" x 23 1/2" plate-girder cross-beams carrying a set of five 4" x 7" I-beam stringers and two 2" x 7" channels on the outsides. The floor system has cross-bracing of 2" x 3" angles. The wooden deck consists of a 4" x 6" nailer on each stringer, 5" x 12" floor planks, and a wearing surface of 2" x 10" planks.

Angle-iron outriggers carry small I-beams for a wooden sidewalk on the north side of the bridge; the sidewalk has a simple pipe railing.

Technological Significance

White Rock Bridge embodies the standardized American truss engineering that had evolved by the early 20th-century. By 1900, steel members, riveted connections, and standard Warren and Pratt truss patterns replaced the pin-connected iron trusses of myriad designs that had characterized the late 19th century.

Two additional characteristics make the bridge typical of its period: the lightness and one-lane width of the highway components, which reflect the fact that motor vehicle usage was still not widespread, and the use of five different truss webs, which saved material but required more design and fabrication effort. In an age when steel was costly and labor relatively inexpensive, such a trade-off made sense. The same principle resulted in the use of members of several different sizes, such as the graduated diagonals or the deeper top chord

in the center of the highway river truss, rather than a single size chosen for the maximum load.

Riveted steel trusses from the first decade of the 20th century are becoming increasingly rare: at the time of the statewide historic bridge inventory (1988), there were only four such trusses from this period still in existence in Rhode Island.

Historical Background

There was no crossing of the Pawcatuck River at this location prior to the construction of the Norwich and Westerly Railway Company's electric railway in 1906. Reportedly, the highway bridge was a condition imposed by the town of Westerly as the price of the railway's using a portion of town-owned land for its right-of-way. In addition to serving residents in the immediate area, the crossing augmented Westerly merchants' access to the Connecticut side of the river. There was some rivalry at the time between Westerly proper and the village of Pawcatuck, which was opposite Westerly on the Connecticut side of the river in the town of Stonington. Presumably, White Rock Bridge helped draw traffic into Westerly that otherwise might have stopped in Pawcatuck.

The Norwich and Westerly Railway Company was a venture of several Norwich and Westerly businessmen, most notably H. H. Gallup, a Norwich manufacturer, and Charles D. Noyes, treasurer of Norwich's daily newspaper, the Bulletin. Noyes's involvement is interesting, since the newspaper explicitly referred to trolley transportation's importance in bringing surrounding rural communities into Norwich's orb; "The Bulletin Follows the Trolley," proclaimed one pitch aimed at advertisers.

To build the line to Westerly, the company hired the National Construction Company (also referred to as the National Construction and Equipment Company) of New York City. As the National Construction Company did not advertize in city directories or trade publications, little is known about the firm other than the names of its president, E. E. McKernan, and its chief engineer, E. W. Jackson. National Construction provided a turn-key operation for the Norwich and Westerly Railway, surveying and arranging for the acquisition of the required right-of-way; representing the company in dealings with the city of Norwich; subcontracting the construction of the roadbed, power plant, car barn, and two substations; buying the rolling stock; and accompanying the Connecticut

Railroad Commission's engineer on the final licensing inspection. The National Construction Company may thus be presumed to have designed and built White Rock Bridge as part of their contract. The total cost of construction, including engineering and equipment, was $1,309,695.00.

The Norwich and Westerly line was considered a high-speed interurban line in its day. Except for a short stretch of street running in Norwich and Westerly, it made use of a dedicated right-of-way. The embankment and ballasting of the track, while not as substantial as steam railroad construction, exceeded the requirements then prevalent for trolley lines; these tasks were primarily carried out by Italian immigrant labor. Many cuts and fills had to be undertaken, and all curves were super-elevated for faster operation. The substantial construction of White Rock Bridge's railway side also demonstrates the exceptional standards of the line. The Norwich and Westerly's rolling stock consisted of eight double-trucked cars built by the Southern Car Company; they were equipped with end doors and multiple-unit controls so that they could be run in sets, and they were of heavy construction, with railroad-style monitor roofs and high-backed seats. The equipment also included one freight motor, intended to serve a milk run through the rural countryside which characterized most of the line.

The cars stopped at the Norwich State Hospital, Hallville, and North Stonington, with some running as Norwich to Westerly expresses. The express running time for the 22-mile route was one hour, with the locals taking 15 minutes longer. Speeds of up to 48 miles per hour were achieved, and the engineers for the route claimed it maintained the highest-speed schedule of any electric railway in New England. The round-trip fare was 60 cents.

The line was opened on August 20, 1906 to a "wild rush of people," and by modern standards, continued to be well patronized. In addition to a regular hourly schedule, the company ran special excursion trains during events such as the New London County Fair, which was held in Norwich in 1906. The railway recorded 500,652 fare-paying passengers in its first full year of operation, with the number increasing to 1,415,813 in 1911, by which time the line had been extended past Westerly to serve nearby beach areas. Financially, however, the line was a disaster. More than 70% of its 1908 revenues of $67,307.60 went to paying off the construction debt, and substantial losses were recorded in six of the first nine years of operation. The Norwich and Westerly Railway Company went into receivership in 1909, just three years after

opening. A new infusion of cash in 1912 gave it marginal profitability, but within two years the losses began again and the railway, renamed the Norwich and Westerly Traction Company, folded a second time. In 1916 the assets were sold to another railway, the Shore Line Electric Railway, which itself went into receivership in 1919. Some segments continued to operate, but most were discontinued and the rail taken up. The last cars on the Norwich to Westerly route ran on December 31, 1922. White Rock Bridge came into the possession of the town of Westerly at this point and remained in highway use for another 50 years.

The Norwich to Westerly interurban line was part of a larger historical development that saw the mill towns and small commercial cities of New England interconnected by electric railways in the early 20th century. Many, like this one, served millions of passenger annually and were virtually the only form of long-distance travel available for routes not served by the steam railroads. Nevertheless, in many cases even this ridership was inadequate to service the debt that these somewhat speculative ventures blithely undertook. The New England interurban lines that survived into the 1920s and 1930s were almost entirely superseded by bus services, many of which were operated by the trolley companies or their successors. Today, there are few remains of these electric railways: the rails were salvaged long ago, and their low embankments have become obscured by overgrowth, erosion, and development. White Rock Bridge thus stands as a rare surviving vestige of the trolley age.

Note on Historical Photographs and Drawings:

No historical photographs or drawings of the bridge were located. The following were investigated as sources of photographs: Rhode Island Department of Transportation, Rhode Island Historical Society, Westerly Public Library historical collections, Connecticut State Archives. The following were investigated as sources of drawings: Rhode Island Department of Transportation, Westerly Department of Public Works, Stonington Superintendent of Highways and Bridges, Connecticut State Archives.

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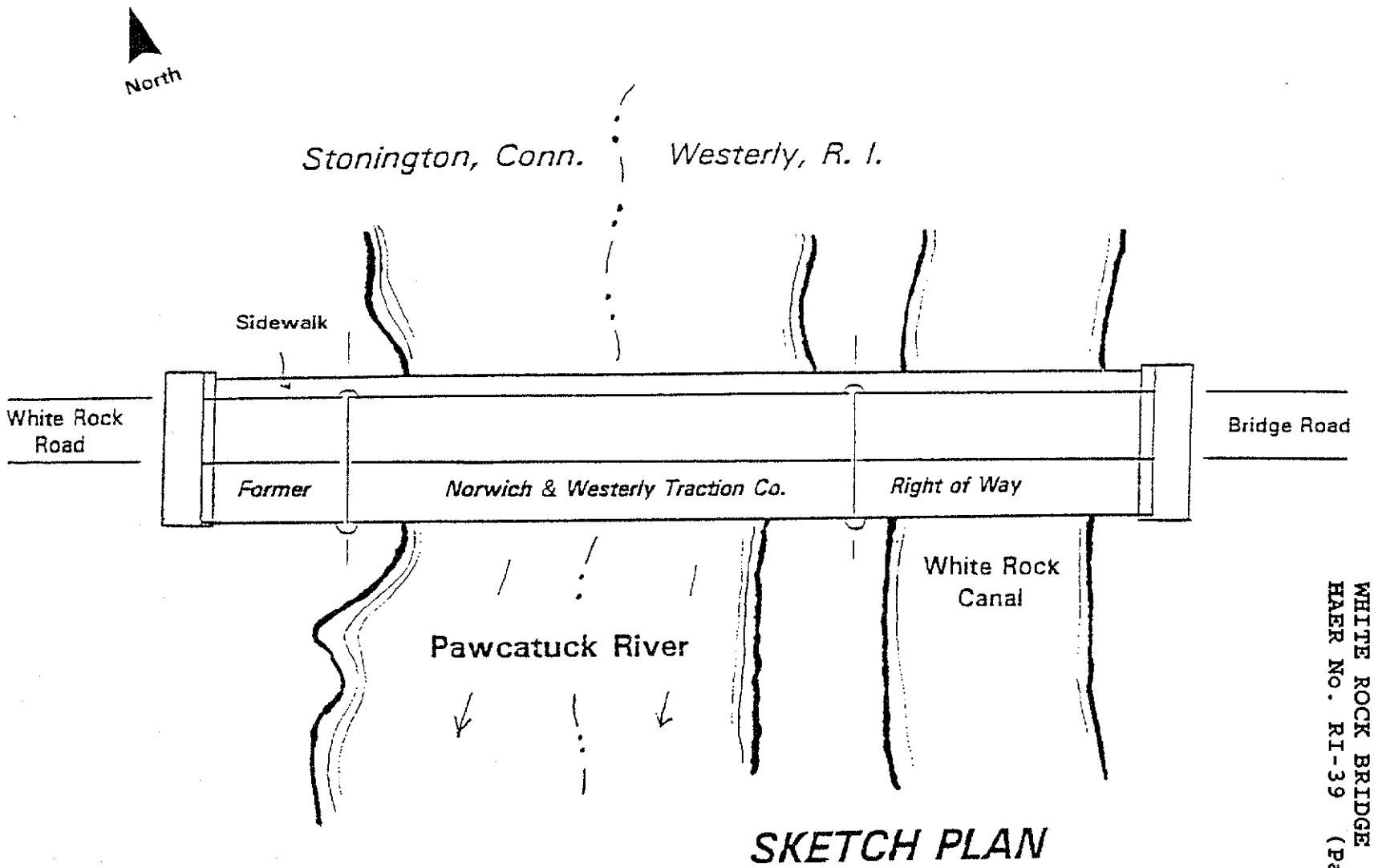
North
Stonington, Conn.
Westerly, R. I.
Sidewalk
White Rock Road
Bridge Road
Former
Norwich & Westerly Traction Co.
Right of Way
White Rock Canal
Pawcatuck River

SKETCH PLAN